VOTING SYSTEMS TESTING

Office of the Secretary of State – Linda McCulloch
Elections and Government Services Division
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Overview

- **Voting System Testing**
  - Overview of the Certification Process
  - Acceptance Test
  - County Internal Test
  - Public Test
  - Election Day Test
- **Test Deck Creation**
  - Tools Needed
  - Different Techniques
- **Ballot On Demand**

The Certification Process

- The U.S. Election Assistance Commission (EAC) has the primary responsibility for assuring that voting system designs meet the applicable guidelines.
  - An EAC certification is an official recognition that a voting system (in a specific configuration or configurations) has been tested to and has met an identified set of Federal Voting Standards.
- If an application for certification is received, state officials are responsible for testing voting systems to ensure that they will support the specific requirements of each State.
- The state will decide whether or not to issue certification.
  - Based on technical and non-technical issues.
- A list of all certified systems can be found on our website.

Legal Requirements

- **13-17-212 MCA. Performance testing and certification of voting systems prior to election.**
- (1) No more than 30 days prior to an election in which a voting system is used, the election administrator shall publicly test and certify that the system is performing properly.
- (2) The secretary of state shall ensure that at least 10% of each type of voting system in the state has been randomly tested and certified at least once every calendar year.

Counties' Role

- Acceptance Testing
- County Internal Testing
- Public Certification Testing
- Election Day Testing

Acceptance Testing

- This type of test should be performed any time a device leaves your control and is returned.
- For example:
  - When a machine is returned from getting repaired.
  - If the machine is borrowed by an organization for demonstration purposes.
- This test is important as it verifies the machine that you receive is identical to the equipment certified on the federal and state level.
- It is included as required testing in the EAC's Voting System Testing and Certification Program Manual.

County Internal

- This test should be run as soon as you receive the ballots and the election media. It should be run on every machine.
- The benefits of running this test include:
  - It's a dry run before your public test.
    - Ensures it is correct before the public test.
    - It helps get your office on board with what to expect during your public test.
  - It will allow you to discover any potential problems in your programming or with your ballots.
  - It should give you ample time to fix any errors prior to the election.

Public Testing

- The public test is done with a test deck prepared by the election administrator.
- It cannot be done more than 30 days before an election.
- Must post a public notice of the time, date and location of the testing.
- This test should be run on all machines, ballot styles, and backup equipment being used by the county.
- Once tested please fill out the Public Testing Certification form, which can be found on the SOS website.
- The Secretary of State's office will request certification documentation on at least 10% of each system used in that calendar year.

Election Day Testing

- On Election Day 5% of each type of voting system must be randomly tested.
- Required to certify testing. Document can be found on the SOS Forms website, or at the back of the Uniform Ballot and Voting System Procedures Guide.

Testing Made Easy

- To make testing easier and more efficient, the Secretary of State created a series of checklists.
- These testing checklists were designed for each of the four previously mentioned tests and they were also designed for the type of system being tested.
- Use one checklist per machine.
  - If you are looking to test 10 AutoMARKS, you will need 10 copies of the checklist.

Testing Made Easy

- The checklists are broken down into four subsections:
  - Physical Analysis
  - Diagnostic Analysis
  - Functional Analysis
  - Security and Storage

Physical Analysis

- This test is used to verify that the device is not physically damaged. This test includes:
  - Inspection of the outer shell or case that contains the device.
  - Inspection of the latches and hinges on the outer shell or case.
  - Inspection of all doors and lock.

Diagnostic Analysis

- This portion of the test is used to confirm that all of the mechanical and electronic components of the device are operating correctly. This test includes:
  - Checking to see if the correct version of the firmware is installed on the device.
  - Test of all input/output devices, such as card readers and printers.
  - Tests of touch-screen clarity and calibration
  - Tests of time, date selection

Functional Analysis

- Tests connections for external devices, such as earphones and personal accessibility devices.
- Test of the ballot feed paths.
- This test consists of loading an election onto the device, casting or marking a known test set of ballots and then counting the votes and comparing the results with the known vote total.
  - Ensure the correct media is with the correct machine.
- This is the test that most people think about when they hear “Voting System Test.”

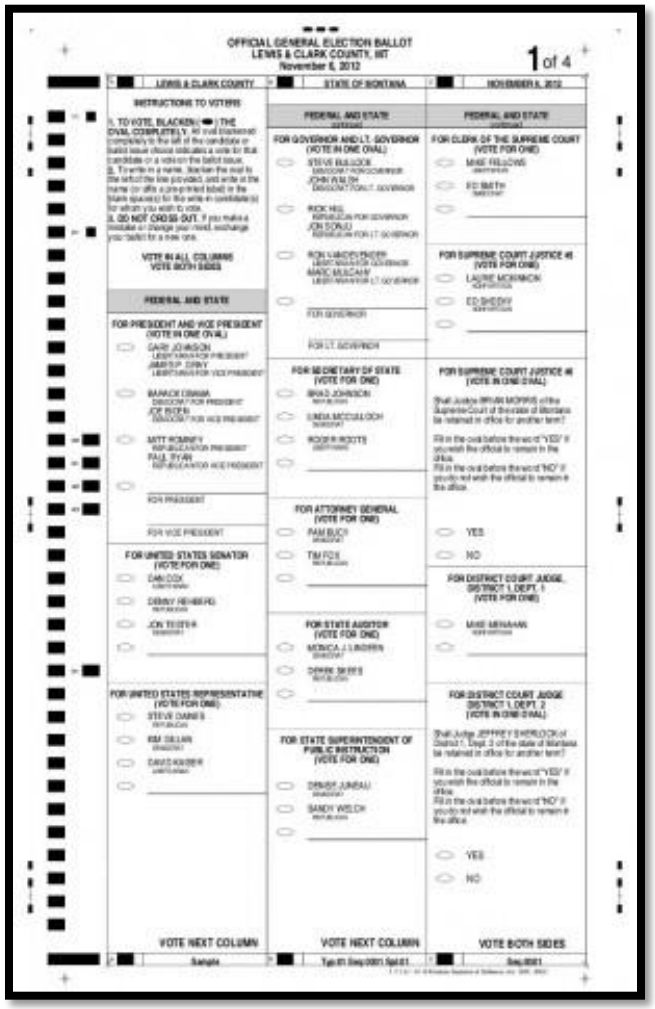
Security & Storage

- Store in a secure location with access recorded and limited to authorized personnel only.
- Ensure that security seals are intact and match the seal numbers on the seal log
  - Security guidelines permit election definition media to be sealed in the terminal during transportation.

A Few Thoughts on the Checklists

- The checklists are test specific, so an Acceptance Test checklist is slightly different from a Election Day Test checklist.
- It's recommended that your office maintains a copy of the test and the results of every test ever conducted on your equipment.
- These checklists can be found on our website in the forms section or in the Uniform Voting Systems Guide.

Test Decks


OFFICIAL GENERAL ELECTION BALLOT
LEWIS & CLARK COUNTY, MT
November 6, 2012
1 of 4
LEWIS & CLARK COUNTY
STATE OF MONTANA
NOVEMBER 6, 2012
INSTRUCTIONS TO VOTERS
FEDERAL AND STATE
FOR PRESIDENT AND VICE PRESIDENT (VOTE IN ONE OVAL)
FOR UNITED STATES SENATOR (VOTE FOR ONE)
FOR UNITED STATES REPRESENTATIVE (VOTE FOR ONE)
FOR GOVERNOR AND LT. GOVERNOR (VOTE IN ONE OVAL)
FOR SECRETARY OF STATE (VOTE FOR ONE)
FOR ATTORNEY GENERAL (VOTE FOR ONE)
FOR STATE AUDITOR (VOTE FOR ONE)
FOR STATE SUPERINTENDENT OF PUBLIC INSTRUCTION (VOTE FOR ONE)
FOR CLERK OF THE SUPREME COURT (VOTE FOR ONE)
FOR SUPREME COURT JUSTICE #6 (VOTE FOR ONE)
FOR SUPREME COURT JUSTICE #6 (VOTE IN ONE OVAL)
FOR DISTRICT COURT JUDGE, DISTRICT 1, DEPT. 1 (VOTE FOR ONE)
FOR DISTRICT COURT JUDGE DISTRICT 1, DEPT. 2 (VOTE IN ONE OVAL)
YES
NO
VOTE NEXT COLUMN
VOTE NEXT COLUMN
VOTE BOTH SIDES

Don't Rely on the Vendors' Test Deck

- The test deck the vendor supplies has likely already been run through and tested before reaching your office.
- Running the test deck just verifies that the deck created by the vendor works on the vendor's machines, with the vendor's programming.
- The tests that you run on these machines are the only tests that will be done before an election to verify the programming is correct.
- The test deck is the only thing that protects the election results from an error in the programming.

Create Your Own Test Deck

- Things you will need
  - Ballots
  - Media
  - Ballot Key
  - Time

Test Deck Basics

- Every ballot variation should be included in your test deck.
  - Every precinct
  - Each party in the primary
  - Each split (if applicable)
- The number of ballots in each test deck may vary from precinct to precinct, depending on number of contests and candidates.

A Test Deck Includes:

- One Blank Ballot
  - Ensures that the machine is not picking up any marks on the ballot at all.
- One completely blacked-out ballot (Minus the tracking marks and the designated marking locations).
  - This test verifies that the software is not reading marks in undesignated areas.

Also Include:

- Overvoted ballot
- Undervoted ballot
- At least one vote for each candidate or ballot issue, including write-ins
- Different vote totals for each candidate/issue
  - This helps verify that the correct choice is getting the correct vote.

Test Folded Ballots

- It may also be wise to test a stack of folded ballots.
- Ensure the ballots are folded in the same manner as your absentee ballots.
- If you are testing a M650
  - Nest the ballots together
  - Single orientation w/corner cut in the upper right corner
  - Scan small stacks: 50-100 ballots
- If you are testing a DS850
  - Nest ballots together
  - You can run the ballots through any orientation
  - Start with small stacks: 100 ballots

Creating a Ballot Key

- A ballot key contains the predetermined vote total for each race.
- Should be one ballot key per precinct being tested.
  - Tip: To help organization, if you are using Excel, ensure that every sheet is titled with the precinct you are working with.
- The ballot key should be kept secret until you are ready to verify the results.

A Possible Testing Approach

- The key takeaways of this method should include:
  - Ensures that each choice receives one vote.
  - Each choice in the race receives a different verifiable total.
  - Filling out the ovals on the ballot is extremely easy as it follows a pattern.

Pattern Ballot Key/Test Deck

- Ballot #1 – Fill out the oval for the first candidate or ballot issue in every race.
- Ballot #2 – Fill out the oval for the second candidate or ballot issue in every race.
- Ballot #3 – Fill out the oval for the third candidate. If a race has less than three candidates or choices, skip this race.
- Ballot #4 – Fill out the oval for the fourth candidate. If a race has less than four candidates or choices, skip this race.
- Ballot #5 – Continue this pattern until every candidate in every race has one vote.

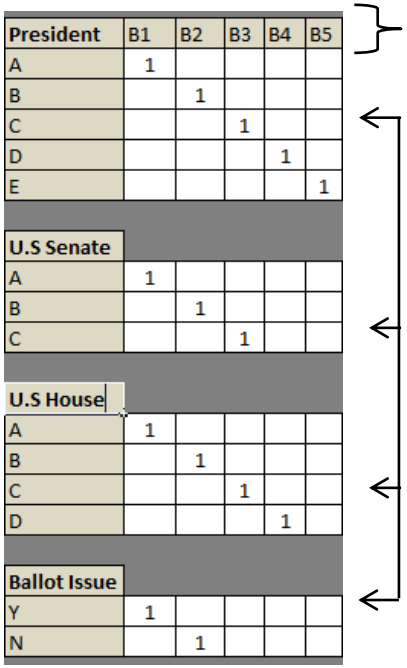
Pattern Ballot Key/Test Deck

- You should now have as many ballots as the race with the most candidates (including write-ins).
  - Example Race #1, has 5 choices you should have 5 ballots.

The First Five Ballots

- At this point, a sample ballot key would look like this.

Candidate Names



President	B1	B2	B3	B4	B5
A	1				
B		1			
C			1		
D				1	
E					1
U.S Senate					
A	1				
B		1			
C			1		
U.S House					
A	1				
B		1			
C			1		
D				1	
Ballot Issue					
Y	1				
N		1			

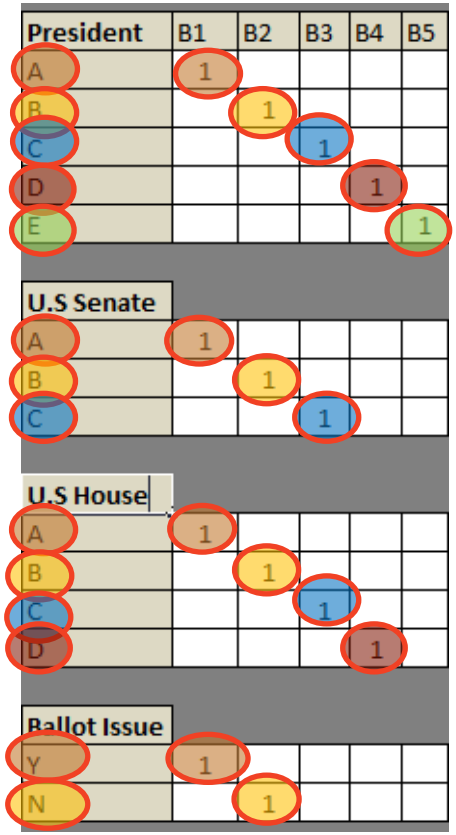
The top row contains the ballot numbers

The Ballot Marking Process

Notice what happens if a race does not have a second/third/etc choice.

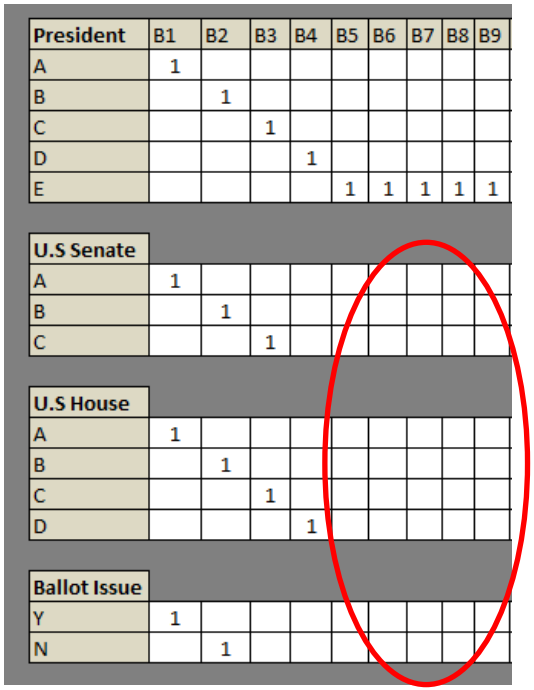
The First Five Ballots

Notice that ballot 1 contains votes for the candidate/ballot issue in ballot position 1, same goes for ballot 2 and so on.



The Next Four Ballots

- To ensure that every choice in the race has a different vote total, you would want to take the race with the most choices (5 in our example) and give one choice that many ballot votes. (In our example we gave candidate E, 5 votes.)



President	B1	B2	B3	B4	B5	B6	B7	B8	B9
A	1								
B		1							
C			1						
D				1					
E					1	1	1	1	1

U.S Senate									
A	1								
B		1							
C			1						

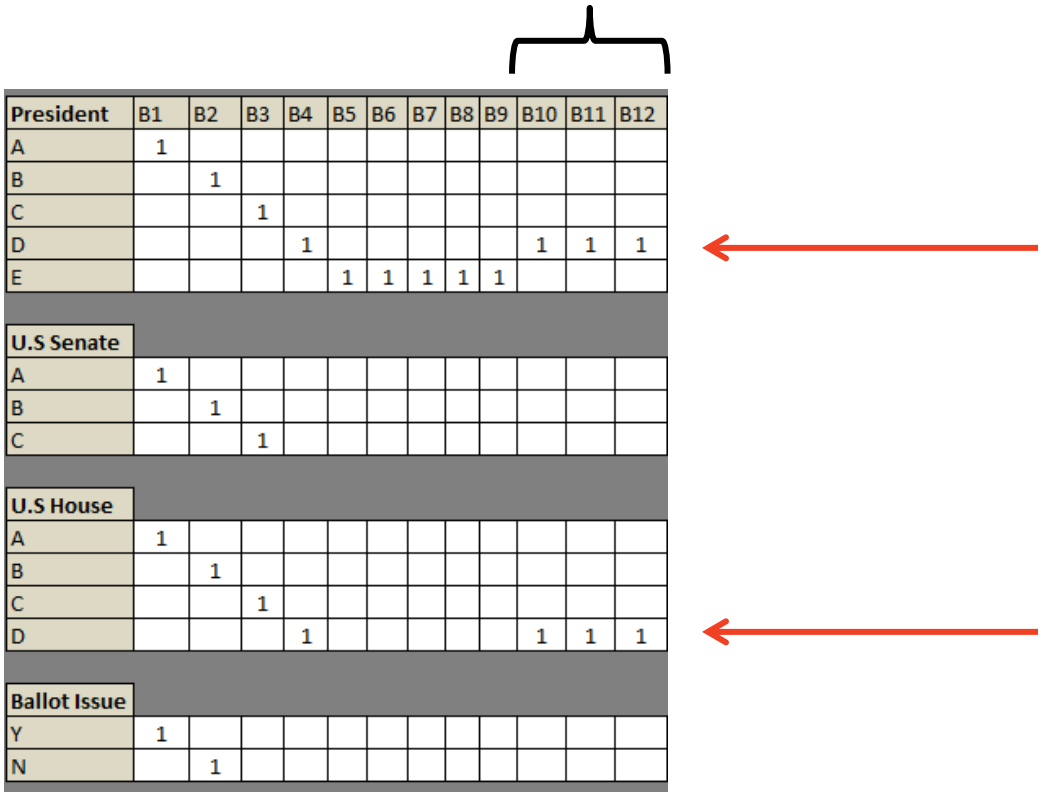
U.S House									
A	1								
B		1							
C			1						
D				1					

Ballot Issue									
Y	1								
N		1							

Note: That no other race has five choices so no votes are given on this ballot.

The Next Three Ballots

- Repeat the process for the next choice.



President	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
A	1											
B		1										
C			1									
D				1						1	1	1
E					1	1	1	1	1			
U.S Senate												
A	1											
B		1										
C			1									
U.S House												
A	1											
B		1										
C			1									
D				1						1	1	1
Ballot Issue												
Y	1											
N		1										

The Next Two..

- …and the next choice

President	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14
A	1													
B		1												
C			1										1	1
D				1						1	1	1		
E					1	1	1	1	1					

U.S Senate														
A	1													
B		1												
C			1										1	1

U.S House														
A	1													
B		1												
C			1										1	1
D				1						1	1	1		

Ballot Issue														
Y	1													
N		1												

And The Last Ballot

- And on the last choice

President	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15
A	1														
B		1													1
C			1										1	1	
D				1						1	1	1			
E					1	1	1	1	1						
U.S Senate															
A	1														
B		1													1
C			1										1	1	
U.S House															
A	1														
B		1													1
C			1										1	1	
D				1						1	1	1			
Ballot Issue															
Y	1														
N		1													1

And The Final Product

- The sample test key is complete.

Every Oval is tested.

President	B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12	B13	B14	B15	Total
A	1															1
B		1													1	2
C			1										1	1		3
D				1						1	1	1				4
E					1	1	1	1	1							5

U.S Senate																
A	1															1
B		1													1	2
C			1										1	1		3

U.S House																
A	1															1
B		1													1	2
C			1										1	1		3
D				1						1	1	1				4

Ballot Issue																
Y	1															1
N		1													1	2

Each candidate receives a different # of votes.

Final Thoughts on This Process

- This approach ensures that each oval on the ballot gets tested.
- Makes it easier to verify that the vote is getting associated to the correct choice.
- Easy to create a test deck and ballot creators will not suffer from fatigue.
- This is a sample of one precinct in the total test deck.

Final Thoughts on This Process

- Does not require an excessive amount of ballots.
  - 3 candidate max race = 6 ballots
  - 4 candidate max race = 10 ballots
  - 5 candidate max race = 15 ballots
  - 6 candidate max race = 21 ballots
  - 7 candidate max race = 28 ballots
  - 8 candidate max race = 36 ballots
  - **Note**: This total does not include ballots for other tests you may want to conduct (overvotes, blank ballots, marginal mark, etc). This is only an example of one precinct.
  - SOS checklists recommend at least 25 ballots in a test deck.

Just Remember…

- This is just one possible method for creating a test deck and it is **not** foolproof**.**
  - Testing the programming of your media can be a very difficult task.
- Not all counties are the same and an alternative method may be better suited.
  - Counties with precinct tabulators may not prefer to have this many undervotes.
  - You may want to test more ballots.
  - You may have a different method set up for determining your ballot key.
  - You may have a race that is multi-vote.

Test Like You Might Find a Problem

- Voting Systems can be very hard to test. The system has many decision points that it makes over the course of a ballot.
  - If you think of something else that you want to test for, do it.
  - The best way to avoid a potential issue on election day is to test for it while you have the opportunity to fix it.
  - If you would like to read more on ballot testing recommendations, read the paper called “Guidelines for Creating Test Ballots” by Josh Washburn
    - https://wei.sos.wa.gov/agency/osos/en/press_and_research/VotingSystems/Assure/2009/documents/other/guidelinesforcreatingtestballots%20with%202009.1.26%20email.pdf

Ballot On Demand

Ballot On Demand

- Potential Issues:
  - Alignment
  - Image scaling
    - Check margins for accurate spacing.
- Testing should meet two criteria:
  - Ballot rejection rate
  - Accuracy error rate

Ballot On Demand

- Test protocols should be designed to limit the variables to only the ballots that are produced from the BOD system.
  - Test BOD after testing voting systems.
- The vote capture device is the largest variable in this kind of testing. All efforts should be made to eliminate it as the source of the possible failures.

Ballot On Demand

- The following measures are recommended:
  - Include ballots that are known to be within the voting system manufacturer's specifications. Label or mark these ballots in a manner that will enable the tester(s) to easily identify them.
  - Use a simple vote pattern to facilitate a clear interpretation of test results.
  - Use only a manufacturer approved marking device.
  - All marks should represent a correctly filled in ballot position.

Ballot On Demand

- Wyle Labs White Paper
  - http://www.nass.org/about-nass/corp-affiliate-white-papers/
    - Winter 2014 tab
    - Testing Considerations for Ballot on Demand & ePollbook Systems